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**Connecticut State Teachers' Retirement System  
Actuarial Valuation  
as of June 30, 2018**



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# Cavanaugh Macdonald

CONSULTING, LLC

*The experience and dedication you deserve*

November 7, 2018

Board of Directors

Connecticut State Teachers' Retirement System

765 Asylum Avenue

Hartford, CT 06105

Members of the Board:

The laws governing the operation of the Connecticut State Teachers' Retirement System provide that actuarial valuations of the assets and liabilities of the System shall be made at least once every two years. We have conducted the actuarial valuation of the System as of June 30, 2018 and the results of the valuation are contained in the following report.

In performing the valuation, we relied on data supplied by the System and performed limited tests on the data for consistency and reasonableness. The valuation was prepared in accordance with the funding objectives of the System as set forth in Chapter 167a, Section 10-183z of the Connecticut General Statutes. The normal cost and accrued liability of the System are developed using the entry age normal cost method. Under this method, the normal cost is the level percent of payroll necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

In determining the System's liabilities, future events, such as investment returns, salary increases, deaths, retirements, etc., are anticipated based upon the set of actuarial assumptions as approved by the Board. The assets of the system for valuation purposes are developed using an asset smoothing technique which spreads the recognition of the unexpected portion of market related gains and losses over a period of four years with the goal of dampening the impact of market volatility upon valuation results.

An unfunded accrued liability exists in the amount equal to the excess of accrued liability over valuation assets. The accrued liability contribution was determined in accordance with subsections (b) and (c) of Section 10-183z of the Statutes. Based on the current valuation, the expected future contributions together with current assets will be sufficient to provide the planned benefits. Therefore, in our opinion, the System continues to operate on an actuarially sound basis.

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Future actuarial results may differ significantly from the current results presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; and changes in plan provisions or applicable law. Since the potential impact of such factors is outside the scope of a normal annual actuarial valuation, an analysis of the range of results is not presented herein.

This actuarial valuation was performed to determine the recommended funding amount for the System. The asset values used to determine unfunded liabilities and funded ratios are not market values but less volatile market related values. A smoothing technique is applied to market values to determine the market related values. The unfunded liability amounts and funded ratios using the market value of assets would be different. The interest rate used for determining liabilities is based on the expected return of assets. Therefore, liability amounts in this report cannot be used to assess a settlement of the obligation.

This is to certify that the independent consulting actuary is a member of the American Academy of Actuaries and has experience in performing valuations for public retirement systems, that the valuation was prepared in accordance with principles of practice prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system and on actuarial assumptions and methods that are internally consistent and reasonable, based on the actual experience of the System.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read 'John J. Garrett'.

John J. Garrett, ASA, FCA, MAAA  
Principal and Consulting Actuary

A handwritten signature in blue ink, appearing to read 'Ben D. Mobley'.

Ben D. Mobley, ASA, FCA, MAAA  
Senior Actuary



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## Section I: Board Summary



The table below summarizes the results of the June 30, 2018 actuarial valuation as compared with the prior valuation.

<b>Table I-1: Comparative Summary of Principal Results</b>		
	<b>June 30, 2016</b>	<b>June 30, 2018</b>
<b>Membership</b>		
Active Members		
Number	50,877	50,594
Annual Payroll	\$3,949,926	\$4,075,939
Retirees and Beneficiaries		
Number	36,065	37,446
Annual Benefits	\$1,831,946	\$1,950,623
Inactive Members		
Vested	2,085	2,194
Non-Vested	12,667	9,291
<b>Assets</b>		
Market Value	\$15,584,564	\$17,946,839
Actuarial Value	\$16,712,316	\$17,951,755
Return on Market Value <sup>1</sup>	1.70%	10.76%
Return on Actuarial Value <sup>1</sup>	7.56%	6.88%
Ratio of Actuarial to Market Value	107.24%	100.03%
<b>Actuarial Information</b>		
Unfunded Actuarial Liability (UAL)	\$13,148,002	\$13,159,143
Funded Ratio	55.97%	57.70%
<b>Computed Contribution Rates</b>		
Normal Cost	10.60%	10.54%
Unfunded Accrued Liability	<u>25.84%</u>	<u>27.50%</u>
Total	36.44%	38.04%
Member*	7.00%	6.00%
State	29.44%	32.04%
<b>State Contribution Amount for Fiscal Year Ending</b>		
June 30, 2018	\$1,271,033	
June 30, 2019	\$1,292,314	
June 30, 2020		\$1,392,183
June 30, 2021		\$1,437,429

*All dollar amounts are in thousands.*

\*Beginning with the June 30, 2018 valuation, employer contribution rate set as though members only contribute 6% of pay.

<sup>1</sup> Two-year compound average return.



## Section I: Board Summary

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### Summary of Key Findings

The employer contribution rate for the System is used to pay the employer's portion of the normal cost and to amortize the unfunded actuarial accrued liability (UAAL).

The actuarially determined normal cost contribution rate was 10.60% as of June 30, 2016 and decreased to 10.54% as of June 30, 2018. The unfunded actuarial accrued liability increased from \$13.148 billion to \$13.159 billion over the two year period. The unfunded actuarial accrued liability rate increased from 25.84% to 27.50%. We note the following key findings:

- The UAAL grew by \$2.007 billion due to interest and decreased by \$1.968 billion due to the amortization payments over the two year period.
- The System experienced actuarial losses on plan assets of \$31 million for fiscal year 2017 and \$338 million for fiscal year 2018 as a result of the investment return on the actuarial value of assets being less than the assumed rate. Table III-3 provides the calculation of the investment losses for the two- year period.
- The System experienced a net actuarial gain of \$425 million as of June 30, 2017 and a net actuarial loss of \$30 million as of June 30 2018 on plan liabilities due to non-investment related experience. Table IV-2 provides the reconciliation of the UAAL which is summarized as follows:
  1. The System provides post-retirement Cost-of-Living Adjustments based upon certain criteria set forth in the statutes. For purposes of the valuation, the benefits paid to eligible retirees and beneficiaries are expected to increase at a rate of 3.00% annually for members retired before September 1992 and 2.00% for members retired on and after September 1, 1992 (1.75% for members hired on or after July 1, 2007). The actual COLAs granted for members retired before September 1, 1992 were 3.0% for 2017 and 3.0% for 2018. The actual COLAs granted for members retired on and after September 1, 1992 were 0.3% for 2017 and 2.0% for 2018. This resulted in a \$268 million gain to the System in 2017 and a \$46 million gain to the system in 2018.
  2. In years where the salaries of active members increase less than expected, an actuarial gain occurs. The System experienced a \$98 million gain due to salary experience for 2017 and a \$128 million gain due to salary experience for 2018.
  3. In addition, there were other gains and losses primarily attributable to the System demographic experience. The gain for 2017 was \$59 million and the loss for 2018 increased plan liabilities by \$203 million.



## Section I: Board Summary

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Section II of the report provides summarized information on the membership data used in the valuation. Section III of the report covers the System's assets and Section IV of the report covers the System's liabilities. The results of the valuation are provided in Section V of the report and the accounting information is in Section VI. The appendices provide additional information on: A) the System members; B) the actuarial assumptions and methods; and C) the summary of plan provisions. In addition, Appendix D provides a glossary of actuarial terminology. It should be noted that all information contained in this report for periods prior to June 30, 2009 was produced by a prior actuarial consulting firm.

## Section II: Membership Data



Data regarding the membership of the System for use in the valuation were furnished by the Retirement Systems. The following table summarizes the membership data as of June 30, 2018 and is compared with that reported for the prior valuation.

<b>Table II-1: Summary of Membership Data</b>		
	<b>June 30, 2016</b>	<b>June 30, 2018</b>
<b>Active Members</b>		
Total Number of Active Members	50,877	50,594
Total Annual Compensation	\$3,949,926	\$4,075,939
<b>Retirees and Beneficiaries</b>		
Number of Service Retirements	33,920	35,201
Total Annual Benefit Payments	\$1,768,348	\$1,881,545
Number of Disability Retirements	283	301
Total Annual Benefit Payments	\$6,874	\$7,647
Number of Beneficiaries	1,862	1,944
Total Annual Benefit Payments	\$56,724	\$61,431
<b>Inactive Members</b>		
Number of Non-vested Inactive Members	12,667	9,291
Number of Vested Inactive Members	2,085	2,194

*All dollar amounts are in thousands.*

## Section III: System Assets



The following tables provide information on the System's assets.

<b>Table III-1: Market Value Reconciliation</b>		
	<b>2016 - 2017</b>	<b>2017 - 2018</b>
Net Market Value as of July 1	\$15,594,872*	\$17,134,326
<b>Additions</b>		
Member Contributions	\$288,251	\$312,150
State Contributions	\$1,012,162	\$1,271,033
Local Government Contributions	<u>\$ 0</u>	<u>\$1,244</u>
Total Contributions	\$1,300,413	\$1,584,427
Investment Income	\$2,251,063	\$1,295,010
Less: Investment Expenses	<u>(\$51,168)</u>	<u>(\$70,079)</u>
Net Investment Income	\$2,199,895	\$1,224,931
Other	\$1,679	\$ 0
Total Additions	\$3,501,987	\$2,809,358
<b>Deductions</b>		
Benefit Payments and Refunds	(\$1,962,533)	(\$1,994,092)
Other	\$ 0	(\$2,753)
Total Deductions	(\$1,962,533)	(\$1,996,845)
Net Increase	\$1,539,454	\$812,513
Net Market Value as of June 30	\$17,134,326	\$17,946,839
Rate of Return on Market Value	14.41%	7.24%
Two Year Compounded Return		10.76%

*All dollar amounts are in thousands.*

\* Restated from previous valuation



## Section III: System Assets

### Development of Actuarial Value of Assets

The Actuarial Value of Assets represents a "smoothed" value developed with the purpose to dampen the impact of market volatility on the assets used in determining valuation results. The Actuarial Value of Assets has been calculated by spreading the recognition of excess investment income over four years. The amount of excess investment income in each year is the difference between expected investment income on actuarial value and the actual market value investment income. Table III-2 provides the development of the actuarial value of assets over the two year period since the previous valuation.

<b>Table III-2: Development of Actuarial Value of Assets</b>		
	<b>June 30, 2017</b>	<b>June 30, 2018</b>
1. Actuarial Value Beginning of Year	\$16,712,316	\$17,331,839
2. Market Value End of Year	\$17,134,326	\$17,946,839
3. Market Value Beginning of Year	\$15,594,872*	\$17,134,326
4. Cash Flow		
a. Contributions	\$1,302,092	\$1,584,427
b. Disbursements	<u>(\$1,962,533)</u>	<u>(\$1,996,845)</u>
c. Net: 4a + 4b	(\$660,441)	(\$412,418)
5. Investment Income		
a. Market Total: 2 – 3 – 4c	\$2,199,895	\$1,224,931
b. Assumed Rate of Return	8.00%	8.00%
c. Amount for Immediate Recognition: (1 x 5b) + (4c x 5b x 0.5)	\$1,310,568	\$1,370,050
d. Amount for Phased-In Recognition: 5a – 5c	\$889,327	(\$145,119)
6. Phased-In Recognition of Investment Income		
a. Current Year: 5d * .25	\$222,332	(\$36,280)
b. First Prior Year	(\$340,740)	\$222,332
c. Second Prior Year	(\$183,028)	(\$340,740)
d. Third Prior Year	<u>\$260,524</u>	<u>(\$183,028)</u>
e. Total Recognized Investment Gain	(\$40,912)	(\$337,716)
7. Total Recognized Investment Return: 5c + 6e	\$1,269,656	\$1,032,334
8. Adjustment	\$10,308	
9. Actuarial Value End of Year: 1 + 4c + 7 + 8	\$17,331,839	\$17,951,755
10. Difference Between Market & Actuarial Values: 2 – 9	(\$197,513)	(\$4,916)
11. Rate of Return on Actuarial Value	7.75%	6.03%
12. Two Year Compounded Return		6.88%

*All dollar amounts are in thousands.*

\* Restated from previous valuation

### Section III: System Assets



The actuarial valuation assumes the investment income on the assets of the System is 8.00% annually. This assumption is based upon the reasonable long-term expected return on the assets. In each year, the System will experience actuarial gains and losses due to the actual investment return of the assets.

**Table III-3: Calculation of Actuarial Investment Gain/(Loss)**

	<b>June 30, 2017</b>	<b>June 30, 2018</b>
1. Actuarial Value of Assets at Beginning of Year	\$16,712,316	\$17,331,839
2. Total Net Cash Flow	(\$660,441)	(\$412,418)
3. Expected Return on Actuarial Value of Assets: $(1 \times 8.00\% + 2 \times 8.00\% \times .5)$	<u>\$1,310,568</u>	<u>\$1,370,050</u>
4. Expected Actuarial Value of Assets at End of Year: $(1 + 2 + 3)$	\$17,362,443	\$18,289,471
5. Actual Actuarial Value of Assets at End of Year	<u>\$17,331,839</u>	<u>\$17,951,755</u>
6. Actuarial Gain/(Loss) Due to Investment Experience: $(5 - 4)$	(\$30,604)	(\$337,716)

*All dollar amounts are in thousands.*



## Section IV: System Liabilities

The present value of benefits is the value as of the valuation date of all future benefits expected to be paid to current members of the System. An actuarial cost method allocates each individual's present value of benefits to past and future years of service. The actuarial accrued liability includes the portion of the active member present value of benefits allocated to past service as well as the entire present value of benefits for retirees, beneficiaries and inactive members. The unfunded actuarial accrued liability (UAAL) is the difference between the actuarial accrued liability and the actuarial value of assets. Table IV-1 shows the allocation of the present value of future benefits into components for future normal cost contributions and actuarial accrued liabilities and the determination of the UAAL as of the valuation date.

<b>Table IV-1: Calculation and Allocation of Present Value of Future Benefits</b>			
	(1)	(2)	(3)
	<b>Present Value of Future Benefits</b>	<b>Entry Age Actuarial Cost Method Portion Covered By Future Normal Cost Contributions</b>	<b>Actuarial Accrued Liabilities (1) - (2)</b>
<b>Active Members</b>			
Service Retirement	\$14,318,163	\$3,209,911	\$11,108,252
Disability Retirement	158,503	99,265	59,238
Survivors' Benefits	262,102	78,462	183,640
Termination	<u>774,946</u>	<u>664,601</u>	<u>110,345</u>
Total for Active Members	15,513,714	4,052,239	11,461,475
<b>Inactive Members</b>			
Non-Vested (Refund only)	170,875	0	170,875
Vested	<u>377,307</u>	<u>0</u>	<u>377,307</u>
Total for Inactive Members	548,182	0	548,182
<b>Retirees and Beneficiaries</b>			
Service Retirements	18,504,247	0	18,504,247
Disability Retirements	87,686	0	87,686
Beneficiaries	<u>509,308</u>	<u>0</u>	<u>509,308</u>
Total for Retirees and Beneficiaries	19,101,241	0	19,101,241
<b>Total</b>	<b>\$35,163,137</b>	<b>\$4,052,239</b>	<b>\$31,110,898</b>
<b>Actuarial Value of Assets</b>			<b>\$17,951,755</b>
<b>Unfunded Actuarial Accrued Liability</b>			<b>\$13,159,143</b>
<b>Funded Ratio</b>			<b>57.70%</b>

*All dollar amounts are in thousands.*



## Section IV: System Liabilities

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The funded ratio of the System is the ratio of the actuarial value of assets divided by the actuarial accrued liability as of the valuation date. As of June 30, 2018, the funded ratio of the System is 57.70% as compared to the ratio in the prior valuation of 55.97%. The ratio is a commonly used measure of the funding progress of a System and can be useful in reviewing the historical trend of a System's funding progress. Such a review should also consider the impact to this measure over the historical period due to changes to plan benefits, changes to the actuarial assumptions and methods, and the significant impact that investment experience can have on the ratio over short-term periods. We caution that no single "point in time" measure can provide a universal basis for comparing one System to another.

Although the terminology used to describe the excess of the System's actuarial accrued liability over the System's actuarial value of assets is called the "unfunded" actuarial accrued liability, there is a dedicated source of funding for this liability. The scheduled employer and employee contributions are expected to completely fund the System's liabilities (pay off the UAAL) based on statutory funding requirements.

The calculation of the System's actuarial liabilities require the use of several assumptions concerning the future experience of the System and its members. In each valuation, the latest year of actual experience is compared to that expected by the prior valuation. The differences are actuarial gains and losses which decrease or increase the UAAL. Table IV-2 provides for the reconciliation of the UAAL and shows the primary sources of this year's gains and losses due to actuarial experience.



**Table IV-2: Reconciliation of the UAAL**

1.	UAAL as of June 30, 2016	\$13,148,002
2.	Expected Amortization Payment	(852,553)
3.	Expected Interest (1 x 8.00% + 2 x 8.00% x 0.5)	<u>1,017,738</u>
4.	Expected End of Year UAAL (1 + 2 + 3)	\$13,313,187
5.	Actuarial Experience (Gain)/Loss	
	Asset Experience	30,604
	COLA	(268,200)
	Salary Experience	(97,563)
	Post-retirement Mortality	4,486
	Retirements	(22,524)
	Turnover and Other	<u>(41,392)</u>
	Total Actuarial (Gain)/Loss	(\$394,589)
6.	UAAL as of June 30, 2017 (4 + 5)	\$12,918,598
7.	Expected Amortization Payment	(1,115,599)
8.	Expected Interest (6 x 8.00% + 7 x 8.00% x 0.5)	<u>988,864</u>
9.	Expected End of Year UAAL (6 + 7 + 8)	\$12,791,863
10.	Actuarial Experience (Gain)/Loss	
	Asset Experience	337,716
	COLA	(46,031)
	Salary Experience	(127,663)
	Post-retirement Mortality	9,495
	Retirements	(30,880)
	Turnover and Other	<u>224,643</u>
	Total Actuarial (Gain)/Loss	\$367,280
11.	UAAL as of June 30, 2018 (9 + 10)	\$13,159,143

*All dollar amounts are in thousands.*



## Section V: Actuarial Valuation Results

Section IV of this report presented the System’s total present value of future benefits allocated between the present value of future normal cost contributions and actuarial accrued liability. The portion of the active members’ present value of benefits allocated to future years of service is funded through annual normal cost contributions comprised of both active member and employer contributions. The System’s annual normal cost rate is calculated as a percent of covered payroll, which is expected to remain level over all future years of service. The portion of the total normal cost rate in excess of the active member contribution rate is the state normal cost rate. The normal cost rate developed as of the valuation date is presented in Table V-1. Table V-1 also shows the state contribution rates necessary to amortize the UAAL in accordance with the funding requirements in the statutes.

<b>Table V-1: State Contribution Rate</b>	
<b>Normal Cost Rate of Active Members by Expected Benefit Type</b>	
Service Retirement	8.35%
Termination	1.70%
Disability Retirement	0.28%
Survivors' Benefits	0.21%
<b>Total Normal Cost Rate for Active Members</b>	<b>10.54%</b>
<b>Less: Active Member Contribution Rate*</b>	<b>6.00%</b>
<b>State Normal Cost Rate</b>	<b>4.54%</b>
<b>Unfunded Actuarial Accrued Liabilities</b>	
Plan in effect 6/30/1991 (13 years)	30.51%
Public Act 87-381 (0 years)	0.00%
Public Act 92-205 (4 years)	(5.05)%
Public Act 98-251 (9 years)	0.02%
Public Act 07-186 (19 years)	2.01%
<b>Total</b>	<b>27.50%</b>
<b>State Contribution Rate</b>	<b>32.04%</b>

\* Beginning with the June 30, 2018 valuation, employer contribution rate set as though members only contribute 6% of pay.



## Section VI: Accounting Statement Information

The Governmental Accounting Standards Board has issued Statement No. 67 which replaces Statement No. 25 for plan years beginning after June 15, 2013. The information required under GASB 67 will be issued in a separate report.

We are providing the schedule of funding progress as shown below for informational purposes. This schedule is no longer required under GASB 67

Table VI-2: Schedule of Funding Progress						
Actuarial Valuation as of June 30	Actuarial Value of Assets ( a )	Actuarial Accrued Liability (AAL) ( b )	Unfunded AAL (UAAL) ( b ) - ( a )	Funded Ratio ( a ) / ( b )	Covered Payroll ( c )	UAAL as a % of Active Member Payroll [( b ) - ( a )] / ( c )
2004	\$9,846.7	\$15,070.5	\$5,223.8	65.3%	\$2,930.8	178.2%
2006	10,190.3	17,112.8	6,922.5	59.5	3,137.7	220.6
2008	15,271.0	21,801.0	6,530.0	70.0	3,399.3	192.1
2010	14,430.2	23,495.9	9,065.7	61.4	3,646.0	248.6
2012	13,734.8	24,862.2	11,127.4	55.2	3,652.5	304.7
2014	15,546.5	26,349.2	10,802.7	59.0	3,831.6	281.9
2016	16,712.3	29,860.3	13,148.0	56.0	3,949.9	332.9
2018	17,951.8	31,110.9	13,159.1	57.7	4,075.9	322.9

*All dollar amounts are in millions*

All figures prior to 6/30/2010 were reported by the prior actuarial firm.

## Section VI: Accounting Statement Information



The information presented above was determined as part of the actuarial valuation as of June 30, 2018. Additional information as of the latest actuarial valuation follows.

Table VI-4: Additional Information	
Valuation date	June 30, 2018
Actuarial cost method	Entry Age
Amortization period	Level percent closed
Remaining amortization periods	
Plan in effect 6/30/1991	13 years
Public Act 87-381	0 years
Public Act 92-205	4 years
Public Act 98-251	9 years
Public Act 07-186	19 years
Equivalent single amortization period	16.6 years
Asset valuation method	Four-year smoothed market value
Actuarial assumptions:	
Investment rate of return (includes inflation)	8.00%
Projected salary increases (includes inflation)	3.25% - 6.50%
Inflation	2.75%
Cost-of-living adjustments	
Retirements prior to September 1, 1992	3.00%
Retirements on or after September 1, 1992	
Hired prior to July 1, 2007	2.00%
Hired on or after July 1, 2007	1.75%



## Appendix A: Additional Membership Data

<b>Table A-1: Schedule of Active Participant Data as of June 30, 2018</b>									
AGE	Years of Service								Total
	Under 5	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 & up	
<b>Under 25</b>	487	1							488
<b>Avg. Pay</b>	47,730	77,790							47,791
<b>25 to 29</b>	3,571	698	2						4,271
<b>Avg. Pay</b>	52,345	58,426	122,524						53,372
<b>30 to 34</b>	2,188	3,443	727						6,358
<b>Avg. Pay</b>	56,318	62,978	72,387						61,762
<b>35 to 39</b>	1,158	1,749	3,882	664					7,453
<b>Avg. Pay</b>	61,442	67,588	79,144	89,846					74,636
<b>40 to 44</b>	702	943	2,050	3,152	370				7,217
<b>Avg. Pay</b>	63,338	70,888	83,208	93,101	102,029				84,951
<b>45 to 49</b>	639	737	1,294	2,286	2,262	212			7,430
<b>Avg. Pay</b>	63,450	71,998	83,659	93,052	100,750	104,383			89,449
<b>50 to 54</b>	380	577	993	1,302	1,441	1,006	284		5,983
<b>Avg. Pay</b>	63,551	71,340	82,968	92,299	97,967	101,940	101,051		90,305
<b>55 to 59</b>	225	367	770	1,052	870	662	1,119	162	5,227
<b>Avg. Pay</b>	63,620	71,574	82,026	91,467	96,756	99,585	99,620	97,550	91,323
<b>60 to 64</b>	115	172	496	832	744	506	616	563	4,044
<b>Avg. Pay</b>	69,053	75,381	81,594	91,102	95,430	98,852	99,746	100,860	93,081
<b>65 to 69</b>	39	67	149	354	339	244	255	290	1,737
<b>Avg. Pay</b>	78,740	82,653	84,571	93,329	95,190	100,570	97,925	103,761	95,635
<b>70 &amp; up</b>	7	3	21	52	65	71	55	112	386
<b>Avg. Pay</b>	61,838	78,574	86,117	92,374	97,829	105,235	97,678	101,468	98,051
<b>Total</b>	9,511	8,757	10,384	9,694	6,091	2,701	2,329	1,127	50,594
<b>Avg. Pay</b>	56,720	66,459	80,833	92,414	98,608	100,939	99,597	101,191	80,562

<b>Table A-2: Comparative Summary of Active Data</b>		
	<b>June 30, 2016</b>	<b>June 30, 2018</b>
Average Age	44.6 years	44.7 years
Average Service	13.7 years	14.0 years
Average Pay	\$77,637	\$80,562



<b>Table A-3: Number of Monthly Retirement Allowances Of Benefit Recipients as of June 30, 2018</b>		
<b>Payee Type</b>	<b>Number</b>	<b>Monthly Retirement Allowances</b>
<b>Service Retirement</b>		
A (Life Annuity)	14	\$32,952
B (100% Cash Refund)	23	74,239
C (Period Certain and Life)	610	2,290,178
D (Joint and Survivor)	7,510	36,204,662
N (25% Cash Refund)	27,044	118,193,434
<b>Total</b>	<b>35,201</b>	<b>\$156,795,465</b>
<b>Disability Retirement</b>		
A (Life Annuity)	0	\$0
B (100% Cash Refund)	0	0
C (Period Certain and Life)	2	3,789
D (Joint and Survivor)	0	0
N (25% Cash Refund)	1	1,907
W (Disability)	298	631,556
<b>Total</b>	<b>301</b>	<b>\$637,252</b>
<b>Beneficiaries</b>	<b>1,944</b>	<b>\$5,119,226</b>
<b>GRAND TOTAL</b>	<b>37,446</b>	<b>\$162,551,943</b>



## Appendix B: Actuarial Assumptions and Methods

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### Investment Rate of Return

Assumed annual rate of 8.00% net of investment expenses.

### Rates of Annual Salary Increase

Rates of Annual Salary Increase Assumption	
Years of Service	
0	6.50%
1	6.50
2	6.25
3	6.25
4	6.25
5	6.25
6	6.25
7	6.25
8	6.25
9	6.25
10	5.50
11	5.50
12	5.00
13	5.00
14	5.00
15	4.75
16	4.50
17	4.25
18	4.00
19	3.75
20	3.50
21+	3.25



## Appendix B: Actuarial Assumptions and Methods

### Active Member Decrement Rates

- a. Table below provides a summary of the assumed rates of service retirement.

Annual Rates of Retirement						
Age	Unreduced		Proratable		Reduced	
	Male	Female	Male	Female	Male	Female
50	27.5%	27.5%			1.00%	1.00%
55	38.5%	27.5%			4.00%	4.75%
60	22.0%	27.5%	6.0%	5.5%		
65	36.3%	32.5%	13.0%	12.5%		
70	100.0%	32.5%	30.0%	14.5%		
75	100.0%	32.5%	30.0%	18.0%		
80	100.0%	100.0%	100.0%	100.0%		

- b. Table below provides a summary of the assumed rates of mortality while actively employed and disability.

Annual Rates of Death and Disability				
Age	Pre-Retirement Mortality		Disability	
	Male	Female	Male	Female
20	0.0377%	0.0147%	0.0341%	0.0500%
25	0.0412%	0.0162%	0.0341%	0.0500%
30	0.0404%	0.0205%	0.0341%	0.0410%
35	0.0448%	0.0272%	0.0341%	0.0410%
40	0.0539%	0.0375%	0.0536%	0.0720%
45	0.0818%	0.0622%	0.1219%	0.1200%
50	0.1476%	0.1116%	0.2438%	0.2630%
55	0.2800%	0.1927%	0.5363%	0.4380%
60	0.4557%	0.2914%	0.9604%	0.5000%
64	0.6572%	0.4272%		



## Appendix B: Actuarial Assumptions and Methods

- c. Table below provides a summary of the assumed rates of withdrawal for active members prior to eligibility for retirement.

Annual Rates of Withdrawal					
10 or more years of service					
Years of Service	Male	Female	Age	Male	Female
0	14.00%	12.00%	25	1.50%	4.00%
1	11.00	10.50	30	1.50	4.00
2	8.00	8.75	35	1.50	3.50
3	6.50	7.50	40	1.50	2.30
4	4.50	6.75	45	1.59	1.50
5	3.50	6.00	50	2.04	2.00
6	3.00	5.25	55	3.44	2.50
7	2.75	4.75	59	4.00	2.90
8	2.50	4.25			
9	2.50	4.00			

### Post-Retirement Mortality

For healthy retirees and beneficiaries, the RPH-2014 White Collar table with employee and annuitant rates blended from ages 50 to 80 projected to the year 2020 using the BB improvement scale and further adjusted to grade in increases (5% for females and 8% for males) to rates over age 80. For disabled retirees, the RPH-2014 Disabled Mortality table projected to 2017 using the BB improvement scale. The following are sample rates for the retirees, beneficiaries, and disabled:

Annual Rates of Death				
Age	Healthy		Disabled	
	Male	Female	Male	Female
50	0.1476%	0.1116%	1.8406%	1.1487%
55	0.2800%	0.1927%	2.2661%	1.3727%
60	0.4557%	0.2914%	2.7070%	1.5886%
65	0.7214%	0.4747%	3.2573%	1.9356%
70	1.1906%	0.8584%	4.0909%	2.6165%
75	2.0499%	1.5897%	5.4230%	3.8159%
80	3.6764%	2.9756%	7.5768%	5.7047%
85	6.9254%	5.4419%	11.1066%	8.5219%

### Marriage Assumption

85% of males and 75% of females assumed to be married, with female spouses 3 years younger than males.

### Asset Valuation Method

The actuarial value of assets recognizes a portion of the difference between the actual market value of assets and the expected actuarial value of assets, based on the assumed rate of investment return. The amount recognized each year is 25% of the difference between market value and expected actuarial value.



## Appendix B: Actuarial Assumptions and Methods

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### Actuarial Cost Method

The Entry Age Normal actuarial cost method allocates the plan's actuarial present value of future benefits to various periods based upon service. The portion of the present value of future benefits allocated to years of service prior to the valuation date is the actuarial accrued liability, and the portion allocated to years following the valuation date is the present value of future normal costs. The normal cost is determined for each active member as the level percent of payroll necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

The unfunded accrued liability is determined by subtracting the actuarial value of assets from the actuarial accrued liability.

### Future Cost-of-living Increases

Members who retired prior to September 1, 1992 are assumed to receive an annual Cost-of-Living Adjustment (COLA) of 3.0%. Members who retired on or after September 1, 1992 and were hired prior to July 1, 2007 are assumed to receive an annual Cost-of-Living Adjustment (COLA) of 2.0%. Members who retired on or after September 1, 1992 and were hired on or after July 1, 2007 are assumed to receive an annual Cost-of-Living Adjustment (COLA) of 1.75%.

### Administrative and Investment Expenses

The investment return assumption represents the expected return net of all administrative and investment expenses.

### Payroll Growth Rate

The total annual payroll of active members is assumed to increase at an annual rate of 3.25%. This rate does not anticipate increases in the number of members.

### Changes from Prior Valuation

None



## Appendix C: Summary of Plan Provisions

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Outlined below are the principal provisions of the system which were reflected in the results shown in this report.

### **Covered Employees**

Any teacher, principal, superintendent or supervisor engaged in service of public schools, plus professional employees at State schools of higher education if they choose to be covered.

### **Annual Salary**

Annual Salary rate for service as a Connecticut teacher during a school year excluding amounts paid for extra duty assignments, coaching, unused sick time, unused vacation or terminal pay.

### **Average Annual Salary**

Average of Annual Salary received during three years of highest salary.

### **Credited Service**

One month for each month of service as a teacher in Connecticut public schools, maximum 10 months for each school year. Ten months of credited service constitutes one year of Credited Service. Certain other types of teaching service, State employment, or war-time military service may be purchased prior to retirement, if the Member pays one-half the cost.

### **Normal Retirement**

Eligibility - Age 60 with 20 years of Credited Service in Connecticut, or 35 years of Credited Service including at least 25 years of service in Connecticut.

Benefit - 2% of Average Annual Salary times years of Credited Service (maximum benefit is 75% of Average Annual Salary)

In addition, amounts derived from the accumulation of mandatory contributions made prior to July 1, 1989 and voluntary contributions by the teacher are payable.

Minimum Benefit: Effective January 1, 1999, Public Act 98-251 provides a minimum monthly retirement benefit of \$1,200 to teachers who retire under the Normal Retirement provisions and who have completed at least 25 years of full time Connecticut service at retirement.

### **Early Retirement**

Eligibility - 25 years of Credited Service including 20 years of Connecticut service, or age 55 with 20 years of Credited Service including 15 years of Connecticut service.

Benefit - Reduced normal retirement benefit. The early retirement factors currently in effect are 6% per year for the first five years by which early retirement precedes the minimum normal retirement age and 4% per year for the next five years by which early retirement precedes the minimum normal retirement age. Effective July 1, 1999, the reduction for individuals with 30 or more years of service is 3% for each year by which early retirement precedes the minimum retirement age.



## Appendix C: Summary of Plan Provisions

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### Proratable Retirement

Eligibility - Age 60 with 10 years of Credited Service.

Benefit - 2% less 0.1% for each year less than 20 years of Average Annual Salary times years of Credited Service in Connecticut, plus 1% of Average Annual Salary times years of additional Credited Service time.

### Disability Retirement

Eligibility - 5 years of Credited Service in Connecticut if not incurred in the performance of duty and no service requirement if incurred in the performance of duty.

Benefit - 2% of Average Annual Salary times Credited Service to date of disability, but not less than 15% of Average Annual Salary, nor more than 50% of Average Annual Salary. In addition, disability benefit under this plan (without regard to any cost-of-living adjustments) plus any initial award of Social Security benefits and workers' compensation cannot exceed Average Annual Salary.

### Termination of Employment

Less than 5 years of Credited Service - Return mandatory contributions with interest.

5 or more years of Credited Service - Return employee mandatory contributions with interest and 1% contributions made prior to July 1, 1989 without interest.

10 or more years of Credited Service - Member is 100% vested in the accrued benefit based on Credited Service and Average Annual Salary as of the date of termination of covered employment. Benefits are payable at age 60 and early retirement reductions are based on the number of years of service the member would have had if they had continued to work until age 60.

Member may elect return of all contributions plus interest on employee mandatory contributions in lieu of vested benefit.

### Pre-Retirement Death Benefits

A lump sum plus one of the following: survivor's benefit, return of all contributions with interest, or surviving spouse's benefit.

- Lump Sum: \$1,000 for the first 5 years of Connecticut service plus \$200 per year thereafter. Maximum benefit: \$2,000.
- Survivor's Benefit: For active teachers who die while in service, the family maximum benefit payable to survivors is \$1,500 per month. Each minor child is entitled to \$300 per month. The surviving spouse's benefit is \$300 per month if the member has 12 or less years of service. For each additional year of service, the surviving spouse's monthly benefit is increased \$25, up to a maximum of \$600.
- Accumulated contributions with interest plus dependent children's benefits as described in the "Survivor's Benefit" paragraph.
- Surviving Spouse's Benefit: An active member who is eligible for immediate retirement and who has named his or her spouse as primary beneficiary will be covered by a 100% Plan D co-participant option in the event of his or her death prior to retirement.



## Appendix C: Summary of Plan Provisions

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### Benefit Options

Normal form: Partial Refund Option – 75% of total benefit is paid as a life annuity. If 25% of the benefits paid prior to death do not exceed the Member’s mandatory contributions plus interest frozen at the date of the benefit commencement, the difference is paid to the Member’s beneficiary.

Optional Forms: 5-, 10-, 20-, or 25-year certain and life and 33-1/3%, 50%, 66-2/3%, 75%, or 100% co-participant annuity (if co-participant dies first, benefit reverts to unreduced amount).

Amounts payable under the optional forms are determined on an actuarially equivalent basis. Actuarial equivalence is determined using mortality as described in Section F of the report, 8.5% interest, and 2% compound COLA. A unisex mortality blend of 60% male was used for certain benefit forms, and a blend of 80% male was used for co-participant annuity forms.

### Cost-of-Living Allowance

For teachers who retired prior to September 1, 1992, pension benefit adjustments are made in accordance with increases in the Consumer Price Index, with a minimum of 3% and a maximum of 5% per annum.

For teachers who were members of the Teachers’ Retirement System before July 1, 2007, and retire on or after September 1, 1992, pension benefit adjustments are made that are consistent with those provided for Social Security benefits on January 1 of the year granted, with a maximum of 6% per annum. If the return on assets in the previous year was less than 8.5%, the maximum increase is 1.5%.

For teachers who were members of the Teachers’ Retirement System after July 1, 2007, pension benefit adjustments are made that are consistent with those provided for Social Security benefits on January 1 of the year granted, with a maximum of 5% per annum. If the return on assets in the previous year was less than 11.5%, the maximum increase is 3%, and if the return on the assets in the previous year was less than 8.5%, the maximum increase is 1.0%

### Teachers’ Mandatory Contribution

Effective July 1, 1992, each teacher is required to contribute 6% of annual salary for the pension benefit. Beginning January 1, 2018, each teacher is required to contribute 7% of annual salary.

### State Contribution

The State’s contribution requirement is determined in accordance with Section 10-183z (which reflects Public Act 79-436 as amended). The additional 1% teachers’ required contribution (above) offsets State required contribution only for the biennium ending June 30, 2019.

### Early Retirement Incentive

A local or regional board of education may establish a retirement incentive plan. The plan shall provide for purchase of additional credited service by a board of education and a member of the system who chooses to participate in the plan, of additional credited service for such member and for payment by the board of education of not less than fifty per cent of the entire cost of such total cost. Any such plan shall specify a maximum number of years to be purchased, not to exceed five. Members must have attained age 50 and be eligible for retirement with the additional purchased service. The amount of service purchased cannot exceed the lesser of five years and one-fifth of the member’s credited service.



***Actuarial Accrued Liability*** - The difference between the actuarial present value of future benefits payments and the actuarial present value of future normal costs. Also referred to as “accrued liability.”

***Actuarial Assumptions*** - Estimates of expected future experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Demographic estimates (rates of mortality, disability, turnover and retirement) are generally based on past experience, modified for projected changes in conditions. Fiscal estimates (salary increases, inflation and real investment return) consist of the underlying rates in an inflation-free environment plus a provision for a long-term average rate of inflation.

***Actuarial Cost Method*** - A mathematical budgeting procedure for allocating the dollar amount of the “actuarial present value of future benefit payments” between future normal cost and actuarial accrued liability.

***Actuarial Present Value*** - The amount of funds currently required to provide a payment or series of payments in the future. It is determined by discounting future payments at predetermined rates of interest and by probabilities of payment. Also referred to as “present value.”

***Actuarial Value of Assets*** - The value of current plan assets recognized for valuation purposes.

***Amortization*** - Paying off an interest-discounted amount with periodic payments of interest and principal, as opposed to paying off with a lump sum payment.

***Experience Gain (Loss)*** - A measure of difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used.

***Normal Cost*** - The annual cost assigned, under the actuarial funding method, to current and subsequent plan years.

***Unfunded Actuarial Accrued Liability*** - The difference between the actuarial accrued liability and actuarial value of assets. Also referred to as “unfunded accrued liability.”